CLAIMS

What is claimed is:

1.   A method of handing off a mobile node from an old sub-network router to a new sub-network router in an Internet Protocol based wireless access network, comprising:

5   using information from a lower layer of the OSI (Open Systems Interconnection) model to notify the mobile node that a connection with the old sub-network router will be discarded within a predetermined amount of time;

obtaining a new care-of address for the mobile node from the new sub-network router;

10   sending a request message from the mobile node to a base node via the new sub-network router requesting a new binding;

creating a new care-of address binding in the base node;

issuing a reply message from the base node to the mobile node via the new sub-network router indicating that the new care-of address binding has been created; and

15   synchronizing a transfer of old care-of address data packets from the base node to the mobile node.

2.   The method according to claim 1, wherein the request message is a mobile node registration request message and the reply message is a mobile node registration reply

20   message.

3. The method according to claim 2, wherein the base node is a home agent and the mobile node is capable of accessing two sub-networks simultaneously, the synchronizing step comprising:

deleting an old care-of address binding from the home agent; and

issuing a deregistration reply message from the home agent to the mobile node via the old sub-network router indicating that the old care-of address binding has been deleted.

4. The method according to claim 3, wherein the mobile node does not receive the deregistration reply message before a predetermined time, the synchronizing step further comprising:

sending a binding update message from the mobile node to the old sub-network router;

creating a binding cache entry in the old sub-network router linking the old care-of address to the new care-of address;

issuing a binding acknowledgment message from the old sub-network router to the mobile node via the new sub-network router; and

forwarding substantially all old care-of address data packets stored or arriving at the old sub-network router to the new care-of address.

5. The method according to claim 2, wherein the base node is a home agent and the mobile node is capable of accessing only a single sub-network at a time, the synchronizing step comprising:

sending a binding update message from the mobile node to the old sub-network router;

creating a binding cache entry in the old sub-network router linking the old care-of address to the new care-of address;

issuing a binding acknowledgment message from the old sub-network router to the mobile node via the new sub-network router;

forwarding substantially all old care-of address data packets stored or arriving at the old sub-network router to the new care-of address;

deleting an old care-of address binding from the home agent; and

issuing a deregistration reply message from the home agent to the mobile node via the old sub-network router indicating that the old care-of address binding has been deleted.

6.   The method according to claim 2, wherein a route optimization function is used, the base node is a home agent, and the mobile node is capable of accessing two sub-networks simultaneously, the synchronizing step comprising:

sending a deregistration binding update message from the mobile node to a correspondent node via the old sub-network router;

deleting an old care-of address binding from the correspondent node;

issuing a deregistration binding acknowledgment message from the correspondent node to the mobile node via the old sub-network router;

sending a binding update message from the home agent to the correspondent node; and

creating a new care-of address binding in the correspondent node.

7.   The method according to claim 6, wherein the mobile node does not receive

the deregistration binding acknowledgment message before the old wireless sub-network has

5   deteriorated beyond a certain point, the synchronizing step further comprising:

sending a binding update message from the mobile node to the old sub-network

router;

creating a binding cache entry in the old sub-network router linking the old care-of

address to the new care-of address;

10   issuing a binding acknowledgment message from the old sub-network router to the

mobile node via the new sub-network router; and

forwarding substantially all old care-of address data packets stored or arriving at the

old sub-network router to the new care-of address.

15   8.   The method according to claim 2, wherein a route optimization function is

used, the base node is a home agent, and the mobile node is capable of accessing only a

single sub-network at a time, the synchronizing step comprising:

sending a binding update message from the mobile node to the old sub-network

router;

20   creating a binding cache entry in the old sub-network router linking the old care-of

address to the new care-of address;

issuing a binding acknowledgment message from the old sub-network router to the mobile node via the new sub-network router;

forwarding substantially all old care-of address data packets stored or arriving at the old sub-network router to the new care-of address;

sending a binding update message from the home agent to a correspondent node; and

creating a new care-of address binding in the correspondent node.

9.   The method according to claim 2, wherein the base node is a gateway foreign agent and the mobile node is capable of accessing two sub-networks simultaneously, the synchronizing step comprising:

deleting an old care-of address binding from the gateway foreign agent; and

issuing a deregistration reply message from the gateway foreign agent to the mobile node via the old sub-network router indicating that the old care-of address binding has been deleted.

10.   The method according to claim 9, wherein the mobile node does not receive the deregistration binding acknowledgment message before a predetermined time, the synchronizing step further comprising:

sending a binding update message from the mobile node to the old sub-network router;

creating a binding cache entry in the old sub-network router linking the old care-of address to the new care-of address;

issuing a binding acknowledgment message from the old sub-network router to the mobile node via the new sub-network router; and

forwarding substantially all old care-of address data packets stored or arriving at the old sub-network router to the new care-of address.

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11. The method according to claim 2, wherein the base node is a gateway foreign agent, and the mobile node is capable of accessing only a single sub-network at a time, the synchronizing step comprising:

sending a binding update message from the mobile node to the old sub-network

10 router;

creating a binding cache entry in the old sub-network router linking the old care-of address to the new care-of address;

issuing a binding acknowledgment message from the old sub-network router to the mobile node via the new sub-network router;

15 forwarding substantially all old care-of address data packets stored or arriving at the old sub-network router to the new care-of address;

deleting an old care-of address binding from the gateway foreign agent; and

issuing a deregistration reply message from the gateway foreign agent to the mobile node via the old sub-network router indicating that the old care-of address binding has been

20 deleted.

12.   The method according to claim 1, wherein the request message is a binding update message and the reply message is a binding acknowledgment message.

13.   The method according to claim 12, wherein the base node is a home agent and the mobile node is capable of accessing two sub-networks simultaneously, the synchronizing step comprising issuing:

sending a deregistration binding update message from the mobile node to the home agent via the old sub-network router;

deleting an old care-of address binding from the home agent; and

sending a deregistration reply message from the home agent to the mobile node via the old sub-network router indicating that the old care-of address binding has been deleted.

14.   The method according to claim 13, wherein the mobile node does not receive the deregistration reply message before the old wireless sub-network has badly deteriorated beyond a certain point, the synchronizing step further comprising:

sending a binding update message from the mobile node to the old sub-network router;

creating a binding cache entry in the old sub-network router linking the old care-of address to the new care-of address;

issuing a binding acknowledgment message from the old sub-network router to the mobile node via the new sub-network router; and

forwarding substantially all old care-of address data packets stored or arriving at the old sub-network router to the new care-of address.

15.   The method according to claim 12, wherein the base node is a home agent

5   and the mobile node is capable of accessing only a single sub-network at a time, the synchronizing step comprising:

sending a binding update message from the mobile node to the old sub-network router;

creating a binding cache entry in the old sub-network router linking the old care-of

10   address to the new care-of address;

issuing a binding acknowledgment message from the old sub-network router to the mobile node via the new sub-network router;

forwarding substantially all old care-of address data packets stored or arriving at the old sub-network router to the new care-of address;

15   sending a deregistration binding update message from the mobile node to the home agent via the old sub-network router;

deleting an old care-of address binding from the gateway foreign agent; and

issuing a deregistration reply message from the gateway foreign agent to the mobile node via the old sub-network router indicating that the old care-of address binding has been

20   deleted.

16.   The method according to claim 12, wherein a route optimization function is used, the base node is a home agent, and the mobile node is capable of accessing two sub-networks simultaneously, the synchronizing step comprising:

.   sending a deregistration binding update message from the mobile node to a

5   correspondent node via the old sub-network router;

deleting an old care-of address binding in the correspondent node;

issuing a deregistration binding acknowledgment message from correspondent node to the mobile node via the old sub-network router;

sending a binding update message from the mobile node to the correspondent node

10   via the new sub-network router;

creating a new care-of address binding in the correspondent node; and

issuing a binding acknowledgment message from the correspondent node to the mobile node via the new sub-network router.

15   17.   The method according to claim 16, wherein the mobile node does not receive the deregistration binding acknowledgment message before the old wireless sub-network has deteriorated beyond a certain point, the synchronizing step further comprising:

sending a binding update message from the mobile node to the old sub-network router;

20   creating a binding cache entry in the old sub-network router linking the old care-of address to the new care-of address;

issuing a binding acknowledgment message from the old sub-network router to the mobile node via the new sub-network router; and

forwarding substantially all old care-of address data packets stored or arriving at the old sub-network router to the new care-of address.

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18.   The method according to claim 12, wherein a route optimization function is used, the base node is a home agent, and the mobile node is capable of accessing only a single sub-network at a time, the synchronizing step comprising:

sending a binding update message from the mobile node to the old sub-network

10   router;

creating a binding cache entry in the old sub-network router linking the old care-of address to the new care-of address;

issuing a binding acknowledgment message from the old sub-network router to the mobile node via the new sub-network router;

15   forwarding substantially all old care-of address data packets stored or arriving at the old sub-network router to the new care-of address;

sending a binding update message from the mobile node to the correspondent node via the new sub-network router;

creating a new care-of address binding in the correspondent node; and

20   issuing a binding acknowledgment message from the correspondent node to the mobile node via the new sub-network router.

19. The method according to claim 12, wherein the base node is a mobility anchor point and the mobile node is capable of accessing two sub-networks simultaneously, the synchronizing step comprising:

sending a deregistration binding update message from the mobile node to the mobility anchor point via the old sub-network router;

deleting an old care-of address binding from the mobility anchor point; and

issuing a deregistration binding acknowledgment message from the mobility anchor point to the mobile node via the old sub-network router.

20. The method according to claim 19, wherein the mobile node does not receive the deregistration binding acknowledgment before the old wireless sub-network has deteriorated beyond a certain point, the synchronizing step further comprising:

sending a binding update message from the mobile node to the old sub-network router;

creating a binding cache entry in the old sub-network router linking the old care-of address to the new care-of address;

issuing a binding acknowledgment message from the old sub-network router to the mobile node via the new sub-network router; and

forwarding substantially all old care-of address data packets stored or arriving at the old sub-network router to the new care-of address.

21.   The method according to claim 12, wherein the base node is a gateway foreign agent, and the mobile node is capable of accessing only a single sub-network at a time, the synchronizing step comprising:

sending a binding update message from the mobile node to the old sub-network router;

creating a binding cache entry in the old sub-network router linking the old care-of address to the new care-of address;

issuing a binding acknowledgment message from the old sub-network router to the mobile node via the new sub-network router;

forwarding substantially all old care-of address data packets stored or arriving at the old sub-network router to the new care-of address;

sending a deregistration binding update message from the mobile node to the mobility anchor point via the old sub-network router;

deleting an old care-of address binding from the mobility anchor point; and

issuing a deregistration binding acknowledgment message from the mobility anchor point to the mobile node via the old sub-network router.

22.   An Internet Protocol based wireless access network, comprising:

a mobile node adapted to obtain a new care-of address from a new sub-network router and to issue a request message via the new sub-network router requesting a new binding upon being notified from a lower layer of the OSI (Open Systems Interconnection)

model that a connection with an old sub-network router will be discarded within a predetermined amount of time; and

a base node adapted to create the new care-of address binding upon receiving the request message from the mobile node and to issue a reply message to the mobile node via

5   the new sub-network router indicating that the new care-of address binding has been created;

wherein the mobile node and the base node are further adapted to transfer old care-of address data packets from the base node to the mobile node in a synchronized manner.

23.   The network according to claim 22, wherein the request message is a mobile

10   node registration request message and the reply message is a mobile node registration reply message.

24.   The network according to claim 22, wherein the request message is a binding update message and the reply message is a binding acknowledgment message.

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25.   The network according to claim 22, wherein a route optimization function is used.

26.   The network according to claim 22, wherein the mobile node is capable of

20   accessing two sub-networks simultaneously.

27.   The network according to claim 22, wherein the mobile node is capable of accessing only a single sub-network at a time.

28.   The network according to claim 22, wherein the base node is a home agent.

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29.   The network according to claim 22, wherein the base node is a gateway foreign agent.

30.   The network according to claim 22, wherein the base node is a mobility

10   anchor point.

31.   The network according to claim 22, wherein the base node is further adapted to delete an old care-of address binding and issue a deregistration reply message to the mobile node via the old sub-network router indicating that the old care-of address binding

15   has been deleted.

32.   The network according to claim 22, wherein the mobile node is further adapted to send a deregistration binding update message to the base node via the old sub-network router, and the base node is further adapted to delete an old care-of address binding

20   therefrom, and issue a deregistration binding acknowledgment message to the mobile node via the old sub-network router indicating that the old care-of address binding has been deleted.

33.   The network according to claim 22, wherein the mobile node is further adapted to send a binding update message to the old sub-network router, and the old sub-network router is adapted to create a binding cache entry linking the old care-of address to the new care-of address, issue a binding acknowledgment message to the mobile node via the new sub-network router, and forward substantially all old care-of address data packets stored or arriving thereat to the new care-of address.

34.   The network according to claim 22, wherein the mobile node is further adapted to send a deregistration binding update message to a correspondent node via the old sub-network router, and the correspondent node is adapted to delete an old care-of address binding therefrom, and issue a deregistration binding acknowledgment message to the mobile node via the old sub-network router.

35.   The network according to claim 22, wherein the base node is further adapted to send a binding update message to a correspondent node, and the correspondent node is adapted to create a new care-of address binding therein.

36.   A method of handing off a mobile node from an old sub-network router to a new sub-network router in an Internet Protocol based wireless access network, comprising:

using information from a lower layer of the OSI (Open Systems Interconnection) model to notify the mobile node that a connection with the old sub-network router will be discarded within a predetermined amount of time;

obtaining a new care-of address for the mobile node from the new sub-network

5   router;

sending a request message from the mobile node to a base node via the new sub-network router requesting a new binding, the base node being predetermined one of a home agent, a gateway foreign agent, and a mobility anchor point;

creating a new care-of address binding in the base node;

10   issuing a reply message from the base node to the mobile node via the new sub-network router indicating that the new care-of address binding has been created; and

synchronizing a transfer of old care-of address data packets from the base node to the mobile node.

15   37.   The method according to claim 36, wherein the request message is a mobile node registration request message and the reply message is a mobile node registration reply message.

38.   The method according to claim 36, wherein the request message is a binding

20   update message and the reply message is a binding acknowledgment message.

39.   The method according to claim 36, wherein a route optimization function is used.

40.   The method according to claim 36, wherein the mobile node is capable of accessing two sub-networks simultaneously.

41.   The method according to claim 36, wherein the mobile node is capable of accessing only a single sub-network at a time.

42.   The method according to claim 36, wherein the synchronization step comprises:

deleting an old care-of address binding from the base node; and

issuing a deregistration reply message from the base node to the mobile node via the old sub-network router indicating that the old care-of address binding has been deleted.

43.   The method according to claim 36, wherein the synchronization step comprises:

sending a deregistration binding update message from the mobile node to the base node via the old sub-network router;

deleting an old care-of address binding from the base node; and

issuing a deregistration binding acknowledgment message from the base node to the mobile node via the old sub-network router indicating that the old care-of address binding has been deleted.

5   44.   The method according to claim 36, wherein the synchronization step comprises:

sending a binding update message from the mobile node to the old sub-network router;

creating a binding cache entry in the old sub-network router linking the old care-of

10   address to the new care-of address;

issuing a binding acknowledgment message from the old sub-network router to the mobile node via the new sub-network router; and

forwarding substantially all old care-of address data packets stored or arriving at the old sub-network router to the new care-of address.

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          45.   The method according to claim 36, wherein the synchronization step comprises:

sending a deregistration binding update message from the mobile node to a correspondent node via the old sub-network router;

20   deleting an old care-of address binding from the correspondent node; and

issuing a deregistration binding acknowledgment message from the correspondent node to the mobile node via the old sub-network router.

46. The method according to claim 36, wherein the synchronization step comprises:

sending a binding update message from the base node to a correspondent node; and

5   creating a new care-of address binding in the correspondent node.